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PETROLEUM IN SOUTHERN CALIFORNIA.

BY S. F. PECKHAM, UNIVERSITY OF MICHIGAN.

THE history of the development of petroleum in Southern California is very interesting. It first attracted attention just at the close of the war, when the energies of the country were again directed to the development of its material resources. The production of oil upon Oil Creek, Pennsylvania, had assumed such proportions as to stimulate effort in all directions for the opening up of every locality, not only in the United States, but in foreign countries where springs of petroleum or deposits of other forms of bitumen encouraged the possibility of repeating the experiences that had attended the drilling of wells along the tributaries of the Upper Alleghany.

Among the persons who had promoted the enterprises that had borne such fruit on Oil Creek none had been more prominent than Professor Benjamin Silliman, Jr., and his contributions to the scientific press upon the oil springs of Pennsylvania soon became classical. It is not surprising, therefore, that when he announced that a duplicate of the oil region of western Pennsylvania existed in the region south of Point Conception and the coast ranges his utterances were accepted as oracular and that commercial enterprises of unlimited dimensions found the most cordial support from capital on both the Atlantic and Pacific coasts.

The insufficient examination given the subject and the shameful imposition practised upon Professor Silliman by those in whom he had a right to place confidence led to both extravagant expenditure and expectation along the whole line of development, so that the collapse of the vast organizations that during 1865-6 attempted to make real the prophecies that had been indulged respecting the possibilities of Ojai, Simi, etc., was more complete and disastrous than it ought to have been, and the reaction robbed the industry of the merit that justly was its due.

While in California in 1865-6 I became convinced that nearly all the wells that were located and drilled during that period were drilled in barren rock, hence their failure to produce oil was not surprising. The tunnels driven by Wheeler and Moss into the Sulphur Mountain and by others in the Newhall District, around the Pico Cañon, demonstrated the fact that petroleum as well as maltha existed in the mountains of this region; but the difficulties of drilling and the small returns realized in any instance, as compared with other wells, particularly in Pennsylvania, led to the most disastrous and complete discouragement for many years.

Added to this was another class of facts scarcely less discouraging. Repeated, and in many instances very costly, experiments fully established the fact that in California petroleum technologists had a new substance to deal with from which commercial articles identical with those obtained from Pennsylvania oils could not be made. The illuminating oils were small in quantity, but they were beautiful in appearance, and were only found to be different from Pennsylvania oils when they were burned; the differences having always from that time to this presented a difficulty in the way of commercial success that is fundamental. In the early days of refining, when it was taken for granted that petroleum was petroleum, wherever found, the petroleum obtained in Southern California, for the most part from tunnels, was attempted to be refined by simple distillation and treatment, as was at the time the custom in Pennsylvania. At this period (1865-6) the technology of Pennsylvania petroleum was extremely simple. Naphtha was a drug in the market and was forced into the burning oil or was burned under the stills, while, with stills being for the most part run to coke, the lubricating oils were dark in color, rank in odor and

generally in ill-repute. When the attempt was made to treat California oils in the same manner, it was found that there was but little naphtha, not much more burning oil, a large proportion of an oil that was neither burning oil nor lubricating oil, and a small amount of oil dense enough and with body enough for lubrication. Wheeler came back from San Francisco, where a trial run had been made, and, in language more graphic than polite, declared that the stuff was "all d—d middlings."

Soon after Professor Silliman took a barrel of Ojai tar (maltha) to Boston and treated it in the experimental still used at the Downer Kerosene Oil Company's works. He produced a certain percentage of illuminating oil. At about the same time I succeeded by distilling the petroleum from the Canada Laga and Pico springs and from the tunnels in Wheeler's Cañon and also a specimen of maltha from the same pool on the Ojai from which Professor Silliman's barrel came, in increasing the yield of illuminating oil to a very respectable percentage. But while the illuminating oil thus produced was colorless and brilliant, it was peculiar, and could never be sold, so far as I have been informed, on its own merits in competition with illuminating oils made from Atlantic coast petroleum.

In this condition the matter rested for many years. A few barrels of oil were produced each year. Some of it was treated, but most of it, so far as I can learn, was sold crude for fuel.

About 1880 a new era dawned. Several gentlemen who had had large experience as oil producers in Pennsylvania, after a thorough study of the stratigraphy of the Sulphur Mountain and the ranges bordering the Santa Clara Valley, located a number of wells on the Ojai ranche and in the Sespé and other cañons that greatly exceeded in productiveness any wells formerly drilled in this region. The location of these wells was made on an entirely different principle from that which determined the location of wells in 1865. With few exceptions the outcrops of bitumen throughout this region are on hillsides into which the strata dip at a high angle. At the foot of these hills the maltha and asphaltum have often accumulated in extensive beds that with the accompanying rubbish sometimes amount to even thousands of tons.

The figure illustrates the situation. A careful study of the section shows conclusively that the well of 1865 might be drilled to any depth without reaching oil, while the location of 1880 presents only mechanical obstacles to the ultimate penetration of the oil-bearing strata. The problems of well-boring in this region present many difficulties. The formation is in the middle tertiary. The rocks are soft and friable and are tilted at very high angles. The wells in western Pennsylvania, after the surface water is cased off at about 300-400 feet, may be drilled to great depths as dry holes. In Southern California, on the contrary, the well must be cased to the bottom, and drilled wet, as it is impossible to case off the water. The well is first started about 12 inches in diameter and the casing driven until it can be forced no further; a second size that will just run inside the first is then inserted and driven like the first until the pressure of the yielding mass of earth and rock holds it too firmly to admit of its being driven further; when a third size is inserted, and so on until a size too small to admit of further drilling is reached. I think few wells 2000 feet deep have been drilled by this method in this region. It is obvious that the difficulties of locating and drilling wells here are very great and that in many instances a well may fail of yielding oil within a few feet of a valuable deposit.

It is but just to myself to say that I advised the superintendent of the California Petroleum Company, operating upon the Ojai ranche in 1865-6, to locate wells at the east end of the ranche, in precisely the location since de-

terminated upon. The successful wells in the Torrey and Sespé cañons have since been located upon the same principle. See the figure.

It is also a fact worth noting that the tunnels driven into the Sulphur Mountain by Wheeler in 1865, the location of which I have elsewhere described, have yielded oil continuously from that time to this and are still yielding oil in moderate quantity.¹

The oil having been obtained, a refinery was constructed at Santa Paula and a pail of the product manufactured into various articles for which a market could be secured. Unlike the natural oils obtained from springs, the oils from wells contained a considerable proportion of naphtha, even light enough to be suitable for use as gasoline. No illuminating oils are produced. The heavier naphthas and oils of a density suitable for illuminating oil are separated and sold without treatment as gas oil. A considerable proportion is then run off as crude lubricating oil, and the

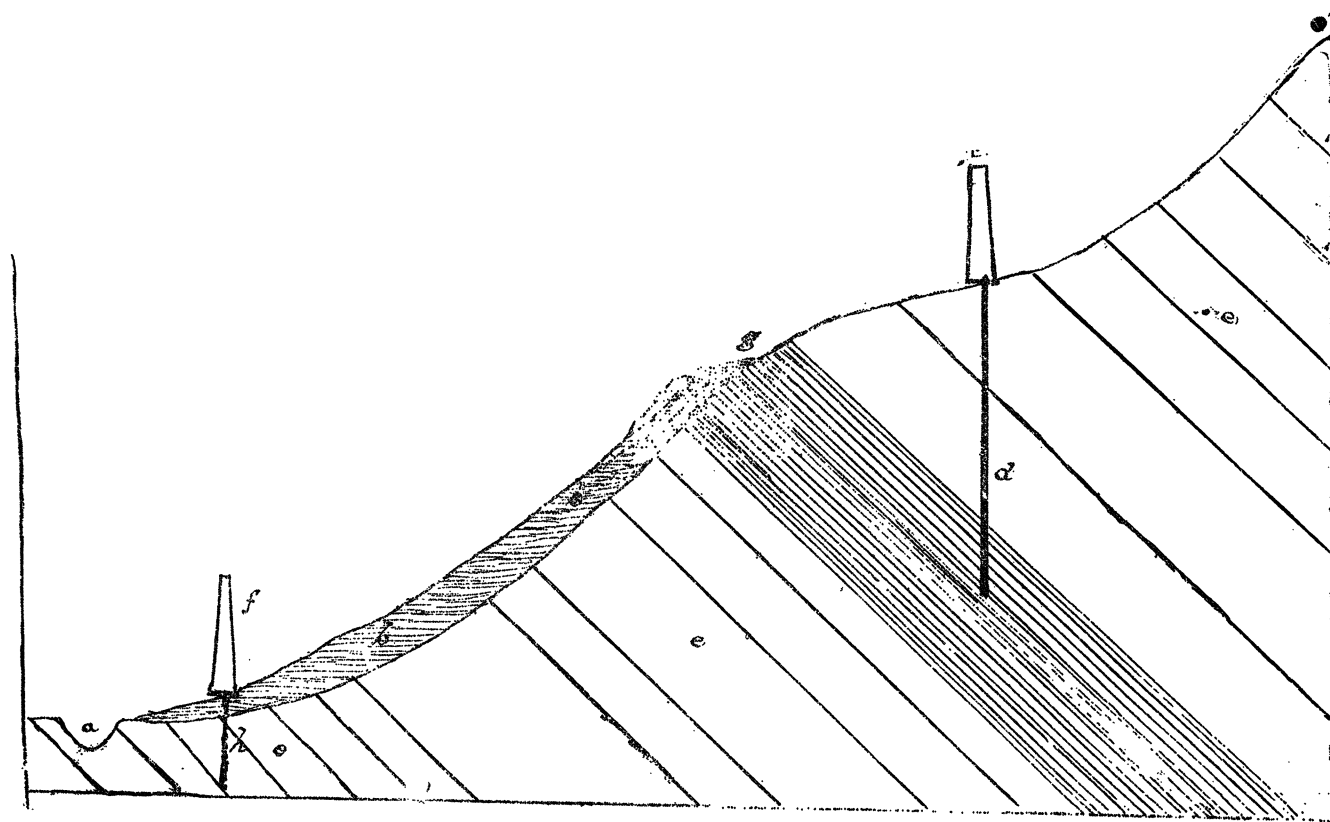
for structures, superior both in durability and appearance to any ordinary form of shingle.

This pure asphaltum is also used as a basis for paints and for coating paper, its purity as bitumen and its freedom from coke and other injurious substances rendering it greatly superior to coke, pitch and many cheaper and undesirable forms of natural bitumen.

Printer's ink of very superior quality is also made one of the products of this remarkable technology.

Besides the refinery at Santa Paula there is another establishment at Alameda Point, in San Francisco harbor, where oils from this region are given similar treatment.

This industry is in its infancy. The purposes to which these remarkable products can be applied are only partially known and very imperfectly appreciated. It is not only my intention to call attention to the fulfilment of predictions made in 1866, that the oil interests of Southern California would ultimately yield a profitable return upon



a, stream at foot of hill; *bb*, mass of maltha, asphaltum and rubbish; *c*, derrick of 1880; *d*, well of 1880; *eee*, barren sand stone strata; *f*, derrick of 1865; *g*, spring of water and maltha from oil-bearing strata pierced by well *d*, of 1880; *h*, well of 1865 in barren sand stone strata.

residue remaining in the still is run out and allowed to cool. This residue is a hard, brilliant, black solid. It is made for different purposes of different grades and degrees of hardness, the hardness depending upon the amount of the crude lubricating oil that is allowed to remain in the residuum. This material is a very pure (almost chemically pure) asphaltum and possesses some peculiar and very valuable properties. Straw board or wood pulp may be saturated with it and rendered nearly inert to acids and alkalis unless in concentrated solution. Straw board cut in suitable sizes may be saturated with it and made into a solid water-proof shingle that when painted forms an elegant and durable external covering

capital invested; but to also call attention to the great scientific interest attaching not only to the geology but technology of the unique and hitherto unfamiliar products of this remote region.

—It is understood that the "History of the United States Navy," upon which Mr. Edgar Stanton Maclay has been engaged for the last nine years, is now nearing completion. It is a curious fact that no complete history of the navy has been published since Fenimore Cooper's time, and Mr. Maclay's elaborate work will meet a demand which has grown stronger since the public became interested in the building up of our new navy. Mr. Maclay's history comes down in 1894. D. Appleton and Co. are the publishers.

¹Reports of the Tenth Census of the United States, Vol. X., Petroleum, p. 68, plate XI.
Geological Survey of California, Geology, Vol. II., appendix p.